Fishery Data Series No. 94-40

Movements of Northern Pike in the Lower Chena River, 1993-1994

by

Gary A. Pearse

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ABSTRACT

Northern pike *Esox lucius* in the Chena River, interior Alaska, were studied for a year from late April 1993, to early May of 1994. A combination of gill nets and electrofishing gear was used to capture 164 pre-spawning northern pike > 299 millimeters fork length in the lower 39 km of the Chena River. The portion of the population of northern pike that was sampled was composed primarily of the Relative Stock Density category of stock-sized fish (300-524 millimeters), with 75% of the sample shorter than 540 mm. Ages 4 and 5 northern pike were most abundant (31%) and equally represented. Nineteen of the sampled fish over 448 mm fork length were implanted with radio transmitters, and attempts at relocation were made intermittently on six occasions between late May 1993 and early May 1994. Seven of the radio-tagged northern pike either died or shed their internal tags near the site of implant sometime during the study, four in Badger Slough and three in other main-river tributaries. Three fish remained in Badger Slough during the winter. Two emigrated to the main Chena river, one of which returned to Badger Slough the following April. The seven remaining northern pike stayed in the lower river near the locations they were tagged and mostly demonstrated local movements. It is highly probable that northern pike sampled in late April and early May, 1993, were captured in proximity to their potential spawning areas.

KEY WORDS: Northern pike, *Esox lucius*, Chena River, length/age composition, radio telemetry.

INTRODUCTION

Background and Study Area Description

Northern pike *Esox lucius* are popular with sport anglers in Alaska. An estimated 100,642 northern pike were caught statewide during 1992, of which 18,616 (18%) were harvested (kept) according to Mills (1993). Excluding anadromous and saltwater species, northern pike ranked third in preference (following rainbow trout *Oncorhynchus mykiss* and Arctic grayling *Thymallus arcticus*) of freshwater fish both caught and harvested statewide during 1992. In the Arctic-Yukon-Kuskokwim region (AYK), where the highest percentage (61%; 11,302) of the statewide harvest of northern pike occurred, northern pike ranked fourth among all species harvested in recreational fisheries, and second for those non-anadromous species considered indigenous to the region. These harvests of northern pike in the AYK region have averaged about 15,103 fish between 1977 and 1992, with a harvest range from 11,302 to 20,771.

Within AYK, harvest of northern pike from waters of the Tanana River drainage comprised 54% (6,148 fish) of the regional total for the species during 1992. East Twin, George, Harding, and Volkmar lakes, in that order, were the sites of the most popular fisheries for northern pike in lakes in the Tanana River drainage during 1992, accounting for 27% (1,647 fish) of the total harvest.

Cursory stock assessment and creel surveys of northern pike in the Tanana River drainage were conducted from 1968 to 1984 (Alt 1969; Cheney 1972; Hallberg 1984; Peckham 1972-1985). Research initiated at Volkmar Lake in 1985 (Peckham 1986) provided the first estimate of northern pike abundance. Research conducted from 1986 through 1993 has provided additional estimates of abundance, along with information on catch-per-unit of sampling effort (CPUE), catchability, sampling methods, life history, age, sex, and size composition and estimates of sustainable yield of northern pike in George, Volkmar, T, and Harding lakes (Peckham and Bernard 1987; Clark et al. 1988; Clark 1988; Clark and Gregory 1988; Timmons and Pearse 1989; Burkholder 1991; Pearse 1990, 1991; Hallberg and Bingham 1992; Pearse and Hansen 1992, 1993; Pearse and Burkholder 1993; Pearse and Clark 1992; Roach 1993; Skaugstad and Burkholder 1992). This report documents research conducted in 1993 and 1994 concerning the composition and movement of northern pike in the Chena River, where another popular recreational fishery for the species occurs.

The Chena River (Figure 1) is one of the largest clear-water streams in the Tanana drainage. The Chena River flows about 240 km from its headwaters northeast of Fairbanks to its confluence with the Tanana River at the southwestern edge of the city. In recent years, average annual flows have been approximately 1,300 cubic feet per second (cfs) and have ranged from 100 to over 70,000 cfs with peak discharges usually occurring in May during breakup. Major tributaries to the Chena River are the South Fork, Middle Fork, West Fork, North Fork and the Little Chena River. Sections of the lower 72 km (45 mi) of the Chena River (downstream of the dam and flood control project) are navigable by propeller-driven outboard-powered river boats, while

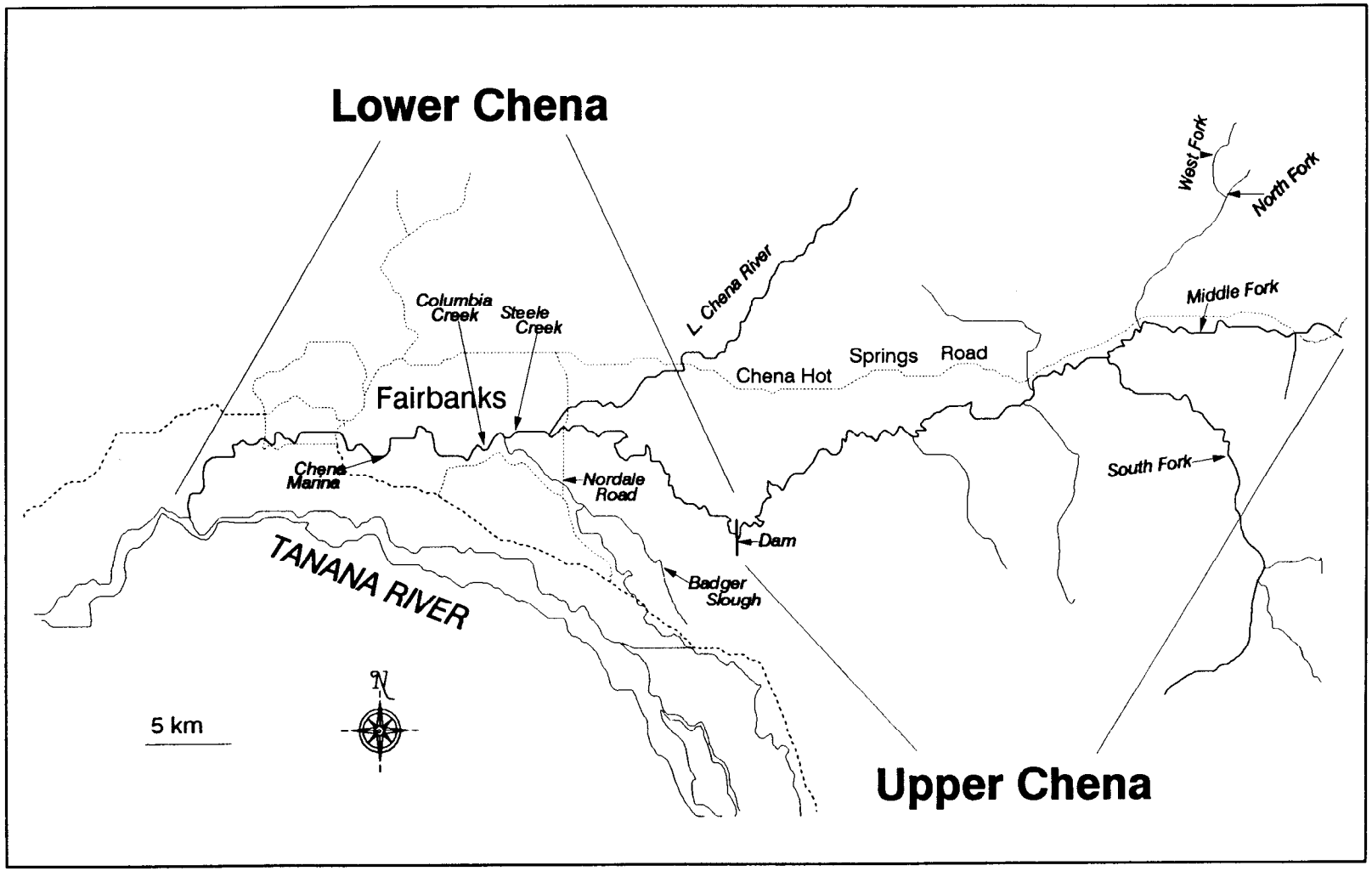

Figure 1. Chena River study area.

portions of the lower river as well as the river segment upstream of the dam are accessible only by boats with jet drives during normal water levels. A portion of the lower river flows directly through the Ft. Wainwright military reservation and then through downtown Fairbanks. As a result, the lower 40 km (25 mi) of the river (from Nordale Road downstream) are readily accessible to the public at numerous locations. Despite its proximity to a major population center and road access to much of the river, most of the Chena River upstream from Nordale Road is undisturbed by human activity.

The Chena River supports seasonal populations of anadromous salmon (chinook *Oncorhynchus tshawytscha* and chum *Oncorhynchus keta* salmon) and sheefish *Stenodus leucichthys*, as well as Arctic grayling, northern pike, round whitefish, broad whitefish and least cisco (*Coregonus* and *Prosopium sp*), burbot *Lota lota*, and long-nose sucker *Catostomus catostomus*. The Chena River has long supported popular recreational fisheries for most of these species, particularly for chinook salmon and Arctic grayling. The recreational fishery for Arctic grayling was at one time considered to be the largest of its kind in the world.

Estimates of northern pike harvest and total effort in angler-days (for all species) have been reported since 1977 by Mills (1993). Estimates of effort have ranged from just under 15,000 to roughly 40,000 angler-days, while harvests have ranged from a low of 169 in 1987 to a high of 1,650 in 1991 (Figure 2). Estimated harvest was approximately 250 northern pike in both 1992 and 1993 (Mills 1994, pers. comm.). Contributions to the estimated average annual harvest of northern pike have generally been apportioned (for the years 1979-1990) among northern pike taken from the upper Chena River (above river kilometer 40 (mile 25) of the Chena Hot Springs road; 10%), those harvested in the Chena River downstream of that point (56%), and Badger Slough (34%). The proportions vary annually, but the majority of harvest has always come from the lower river including Chena (Badger) Slough. At the recommended conservative exploitation rate of 15% for the species (Pearse 1991), the average annual harvest of 618 northern pike for the years 1977-93 would need to be supported by a population of approximately 4,200 fish. The abundance of northern pike resident year round in the Chena River is unknown, as is the contribution to harvest from immigrant stocks.

Study Objectives

The specific objectives for 1993, Project: F-10-9, Job R-3-4 (c) were to estimate the length and age compositions of northern pike sampled within the Chena River, and monitor patterns of seasonal aggregation and dispersal of northern pike implanted with radio tags in selected areas of the Chena River. Because northern pike were captured once with size- (age-) selective gear (gill nets and electrofishing), there was no assurance that the sample was representative of the actual length and age composition of the population. Thus, this report presents statistics on length and age of captured northern pike, and a summary of seasonal locations of radio-tagged northern pike in the Chena River.

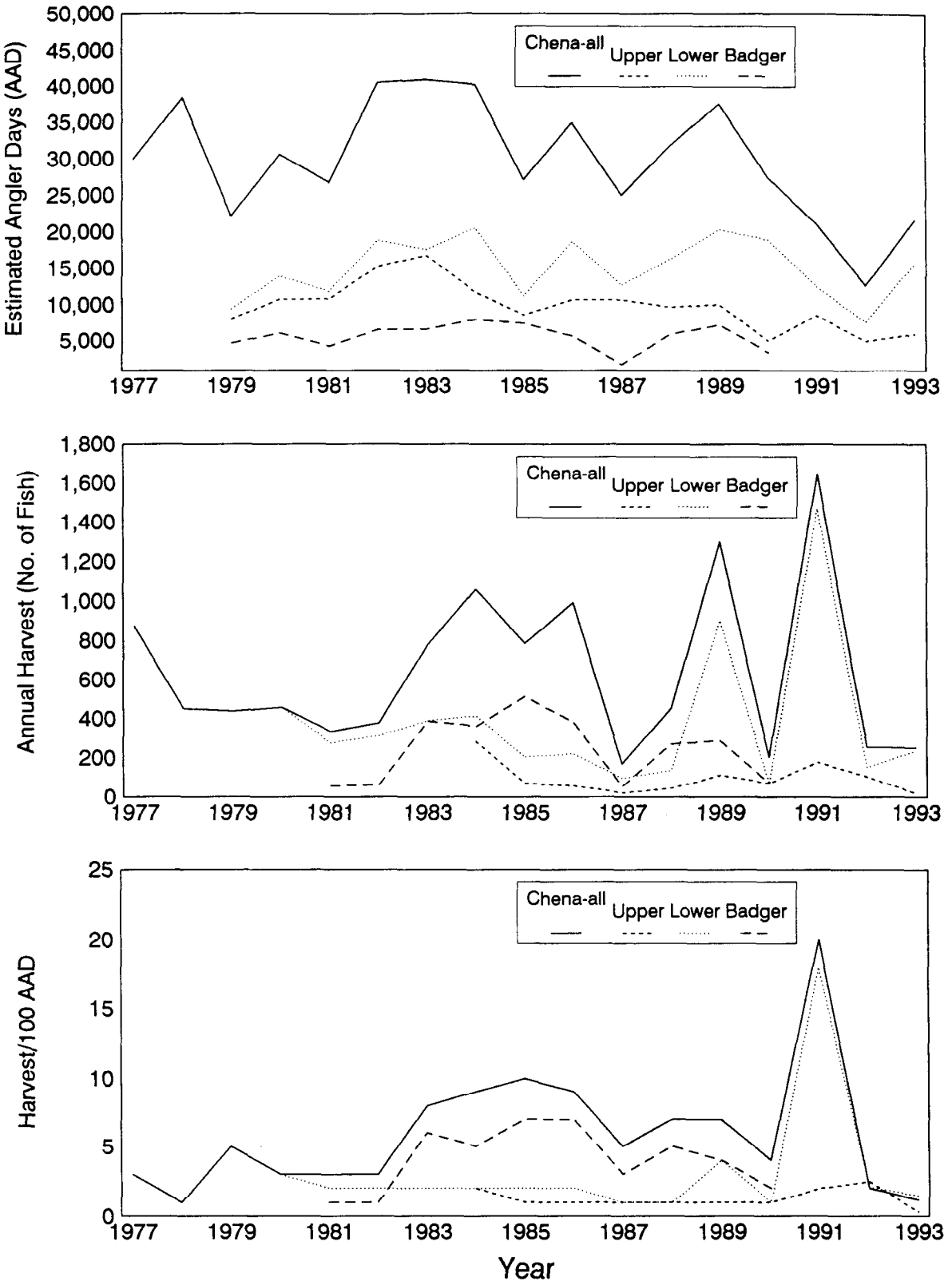

Figure 2. Annual recreational fishing effort (angler-days) and harvest for northern pike in the Chena River, 1977-1993.

METHODS

Study Design

Population sampling of northern pike in the Chena River was conducted from late April to late July, 1993. Prior experience indicated that population studies of northern pike in interior Alaskan waters are best conducted during and immediately after the spawning period, which coincides with spring ice melt during mid to late May. Northern pike concentrate at this time to spawn and later feed making them more available to the sampling gear. Low water temperatures minimize temperature-sensitive handling injuries (Peckham and Bernard 1987; Clark 1988; and, Pearse and Clark 1992).

Six-panel 46 m gill nets, both floating and sinking, with two-each panels of 25, 38, and 51 mm bar mesh multifilament netting, dyed green, were set in tributary creeks and marshes considered likely spawning areas off the main river channel of the Chena River. Badger Slough, a major tributary to the mainstem 34 km from the mouth, was intensively sampled at major access sites (road crossings) throughout its length. Overall, the areas sampled in the Chena River ran from the confluence with the Tanana River to approximately 10 km above the flood control project (river kilometer 90). Only limited attempts were made to sample the main river with gill nets. Up to five nets were employed at each sampling location until catches diminished.

In addition to gill nets, electrofishing gear (either backpack or boat mounted) was used either to stimulate fish to move into nearby gill nets, or as a capture method by itself in tributary areas. Electrofishing in the mainstem river, conducted primarily for estimates of abundance and composition of Arctic grayling stocks, also resulted in the capture of northern pike. Data from northern pike captured during such activity were combined with data from northern pike captured by other methods described to assess composition. Northern pike captured while electrofishing for Arctic grayling also provided healthy mature (>450 mm FL) fish for radio implantation. Frequent gill net checks eliminated handling mortality, and electrofishing proved non-injurious to the northern pike captured as no known mortalities occurred during sampling.

Radio-telemetry was used to track the movements and determine the seasonal distributions of 19 northern pike in the Chena River. Telemetry has proven to be an effective method of determining the location of fish with implanted transmitters. Studies conducted by the Alaska Department of Fish and Game which describe methods of implantation and relocation relative to northern pike include those by Hallberg (1984), Holmes and Burkholder (1988), Pearse and Clark (1992), Roach (1993), and Burkholder and Bernard (1994). The underlying intent of this component of the study was to gain further insight into the seasonal utilization of habitat in the lower Chena River and Badger Slough, areas exposed to relatively intensive fishing effort during ice-free periods.

Data Collection

Location of each netting site was either recorded in field notebooks, or in the case of electrofishing in the main river, directly on mark-sense forms. Separate maps were used during each sampling event when radio-tagged fish were relocated. Each fish captured during sampling was measured to the nearest millimeter FL (mm), sex was recorded if determined by the extrusion of gametes, and scale samples were taken. Northern pike were released in the area of capture.

All captured northern pike were examined for Floy tags from other locations. Northern pike judged to be healthy were released after being marked with a gray Floy FD-68B internal anchor tag (Floy Tag & Mfg., Inc., Seattle, WA.) inserted posteriorly at the left base of the dorsal fin during all daily sampling events. A second mark (dorsal clip) was applied to all tagged fish to later determine tag loss from recaptured fish (none were recaptured).

Scales were removed from each fish, regardless of capture occasion, to estimate age. A minimum of three scales were taken from the preferred zone adjacent to the lateral line above the pelvic fin as described by Williams (1955). Scales were then mounted directly on gummed cards marked (with litho-code number) to correspond with the respective field data form. The cards were used to make scale impressions on 20 mil acetate sheets using a Carver press at 137,895 kPa (20,000 psi) heated to 93°C for one min. Scales were read on a microfiche reader (32x) and ages estimated in accordance with age identification criteria established by Williams (1955) and Casselman (1967). Because experience has shown that the formation of scale annuli in Alaskan stocks of northern pike generally coincides with the sampling period in late May, ages assigned corresponded to counts of annuli detected on the scales.

The radio-transmitters used in this study were manufactured by AVM Instrument Company, LTD (Livermore, California), model SM1-H. This unit is of standard manufacture, watertight, with single-stage design (no amplifier circuit), and powered by a 3.6 volt lithium battery. The length of the radio-transmitters (excluding antenna) were 4.0 cm, the diameter 1.5 cm, the weight ranged from 14 g to 15 g, and the length of the external antenna was 49 cm. Each radio-transmitter had a unique frequency between 149.150 and 149.460 Mhz, with a 10 Khz spread between adjacent tags, and an expected life of 14 months at 85 to 95 pulses per min.

Between 26 April and 7 May 1993, 19 radio-transmitters were surgically implanted in 8 male (length range 448 mm to 540 mm FL) and 11 female (length range 451 mm to 737 mm FL) northern pike. Sex was easily determined for these fish because of the presence of sex products. The radio-transmitters were placed in the coelomic cavity through a 2 cm incision along the linea alba, anterior to the pelvic girdle (Hart and Summerfelt 1975). Three to five sutures were necessary to close the incision. The outlet incision for the trailing antenna was posterior to the pelvic girdle. This procedure was similar to the method described by Ross (1982), with the exception that a

blunt needle was used to guide the antenna to the outlet incision instead of a shielded needle. Radio-tagged fish were immediately released after regaining equilibrium.

Tracking each fish was attempted during six seasonal periods from 27 May 1993 through 3 May 1994. For each tracking event, all frequencies were programmed into a TS-1 scanner-programmer that was attached to a TR-2 receiver (both manufactured by Telonics, Inc.[1]). Locating transmitters consisted of flying in a Cessna 185 equipped with the above receiving equipment while listening for a signal with a four-element directional "Yagi" antenna (model P150-4 with 9 dBd gain, manufactured by Cushcraft, Inc.[2]) attached to the right wing lift strut. Flights were parallel to stream courses and were conducted at 120 km/h from 150 to 300 m above the terrain. When a signal was received, the gain on the receiver was reduced to help in locating the position of the fish. A reduction in signal strength while flying the stream course in the direction of the signal was an indication that the transmitter had been passed over. A second pass in the opposite direction over the expected location confirmed the presence.

The locations of each fish were plotted on maps of the Chena River derived from a USGS 1:24,000 map, and separate maps with locations were prepared for each tracking interval. Comparison of locations determined by aerial means on 25 April 1994 were compared with visual contact and/or short-range (> 2 m) electronic locations determined 3 to 5 May 1994. It was possible to determine transmitter location on the ground to within 2 m by detecting a signal with the receiver with no antennae attached, since the receiver would not detect a signal from greater than 2 m with no antennae. Transmitters that were relocated at short range (less than 2 m) that failed to move on relocation were considered to either be in dead fish or to have been expelled from the fish. Of the seven transmitters located during the latter period that were either in dead fish or had been expelled from the fish, the greatest difference noted between the two location methods was approximately 1 km. This worst-case scenario was therefore assumed to be the best practical accuracy of relocations by the aerial method, and any northern pike relocated within that distance from the previous location was assumed to not have moved.

Data Analysis

Statistics on Length and Age:

The sample of northern pike was apportioned into the following categories similar to that reported upon for populations in Tanana drainage lakes by Pearse (1994):

1. "Small" (300-449 mm), "Medium" (450-749 mm), "Large" (750 mm and larger);

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[1] Telonics, Inc., 932 E. Impala Ave., Mesa, AZ.
[2] Cushcraft, Inc. P.O. Box 4680, 48 Perimeter Rd. Manchester, NH 03108.

2. Relative Stock Densities (RSD; Gabelhouse 1984) in "stock" (300-524 mm), "quality" (525-654 mm), "preferred" (655-859 mm), "memorable" (860-1,079 mm), and "trophy" (> 1,079 mm) FL classes;

3. Length frequency of the sampled northern pike in 10 mm categories; and,

4. Proportions by age.

Estimates of mean length-at-age were also reported.

Radio-Telemetry:

The objective of this task was to examine aggregation and dispersal of the radio-tagged northern pike on a seasonal basis. To facilitate the examination, an electronic map of the Chena River was prepared, and location data for the relocated northern pike transferred to this format for visual inspection. Relative movement between relocation intervals was determined. Movement was considered the shortest river course distance moved between relocations in excess of 1 km.

Northern pike implanted with radio transmitters were assigned numbers (1 through 19) by date and implant location. These numbers were assigned as follows: 28-29 April 1993, lower Badger Slough (river kilometer 38.3), numbers 1-9; 5 May 1993, Chena Marina (river kilometer 25), numbers 10-14; 6 May 1993, Lower Columbia Creek mouth (river kilometer 33.3), numbers 15-16; 6 May 1993, Upper Columbia Creek mouth (river kilometer 35), numbers 17-18; and 7 May 1993, Steele Creek mouth (river kilometer 38.8), number 19. All implants occurred below river kilometer 39.

RESULTS AND DISCUSSION

Statistics on Length and Age

The Small size category contributed 36.1% of the sample's makeup in 1993 (Table 1). Fish in the Medium size range predominated, and equaled 63.3% of the sample in 1993. Fish over 749 mm contributed 0.6% of the overall estimate. Medium and Large sized northern pike consist primarily of fish fully recruited to the spawning population.

Estimated RSDs (Table 2) indicated the stock (65.2%) and quality (28.5%) categories predominated. Preferred sized fish comprised 6.3% of the sample, with few if any captured in the memorable and trophy size groups.

Table 1. Proportion of northern pike (> 299 mm FL) by size group in the sample taken from the Chena River, 1993.

Size Group	Sample Size	Proportion
Large	1	0.006
Medium	100	0.633
Small	57	0.361
Total	158	

Table 2. Proportion of northern pike (> 299 mm FL) by RSD category in the sample taken from the Chena River, 1993.

RSD Category[a]	Sample Size	Proportion
Trophy	0	---
Memorable	0	---
Preferred	10	.063
Quality	45	.285
Stock	103	.652
Total	158	

The cumulative length frequency distribution of sampled northern pike (sexes combined) is described in Table 3 and Figure 3. Approximately 25% (39) of the fish sampled (164) were shorter than 410 mm, 50% (79) of the fish sampled were shorter than 470 mm, and about 75% (119) of the northern pike captured were less than 540 mm.

In 1993, the age 4 and 5 cohorts accounted for the highest percentage (31%) in the sex-combined data (Table 4). Ninety two percent of northern pike sampled were age 6 and younger. The mean length-at-age data (Table 5) indicates increasing length with increasing age. Five year old fish sampled in the Chena River averaged 518 mm (SE = 7 mm).

Of the 164 northern pike sampled in this study, 23 (14%) were female and 30 (18%) were male. The remaining 111 (68%) were classified as sex unknown because these fish had spawned prior to sampling and could not accurately be sexed.

Radio Telemetry

Location data from radio-tagged fish is summarized in Table 6, and shown for both implant and subsequent relocation events by time interval in Figures 4 to 10. Of nine northern pike implanted with tags in Badger Slough, four (numbers 1, 2, 5, and 9) were assumed dead a year later on 3-4 May 1994. These fish were assumed dead since a ground relocation of the tags from a distance of less than 2 m failed to produce any movement of the fish. Three of these fish were relocated under shelf ice grounded to the bottom, and the fourth (number 5) was in shallow water with no fish visible. The location in all cases was confirmed by operating the tracking receiver without an antenna, and locating the transmitter within a close proximity (2 m). No transmitters were recovered. All but one (number 5) of the fish that were located in early May, 1994 were in proximity to implant location and probably died soon after implant or had the transmitter removed by anglers. Whether or not the transmitters were discarded after angler harvest, became separated from the dead fish, or were still attached to the carcass is unknown, as ice cover or dense vegetation prevented visual sighting. It is unlikely that the northern pike could have shed the internal tags and survived. Of the remaining five northern pike implanted in Badger Slough, two (numbers 6, 8) moved out of Badger Slough of which one (number 6) returned in late April 1994. Fish number 8 had moved out of Badger Slough by late May 1993 (possibly after spawning), and then moved 18 km up the Chena River where it was last located in late April 1994. Three northern pike remained in the Slough throughout the study (numbers 3, 4, 7), and all showed some movement between at least one tracking interval. Of these five northern pike tagged in Badger Slough, only one (number 3) was observed alive and actively swimming a year after implantation (3-4 May 1994).

Ten northern pike were implanted with radio transmitters in the main river (numbers 10-19). The locations of implant are shown in Figure 4. The transmitter from fish number 19 was returned in June 1993 by an angler who caught the fish near its tagging location in Steele Creek. Of the remaining

Table 3. Percent length frequencies of all northern pike sampled in the Chena River, 1993.

Length Category	Frequency	Percent	Cumulative Frequency	Cumulative Percent
300	1	0.6	1	0.6
310	5	3.2	6	3.8
320	2	1.3	8	5.1
330	1	0.6	9	5.7
340	3	1.9	12	7.6
350	1	0.6	13	8.2
360	2	1.3	15	9.5
370	4	2.5	19	12.0
380	6	3.8	25	15.8
390	5	3.2	30	19.0
400	1	0.6	31	19.6
410	8	5.1	39	24.7
420	7	4.4	46	29.1
430	5	3.2	51	32.3
440	6	3.8	57	36.1
450	8	5.1	65	41.1
460	7	4.4	72	45.6
470	7	4.4	79	50.0
480	5	3.2	84	53.2
490	6	3.8	90	57.0
500	8	5.1	98	62.0
510	2	1.3	100	63.3
520	4	2.5	104	65.8
530	8	5.1	112	70.9
540	7	4.4	119	75.3
550	4	2.5	123	77.8
560	5	3.2	128	81.0
570	3	1.9	131	82.9
580	3	1.9	134	84.8
590	3	1.9	137	86.7
600	5	3.2	142	89.9
610	2	1.3	144	91.1
630	1	0.6	145	91.8
640	3	1.9	148	93.7
650	1	0.6	149	94.3
670	2	1.3	151	95.6
680	2	1.3	153	96.8
690	1	0.6	154	97.5
710	1	0.6	155	98.1
720	1	0.6	156	98.7
730	1	0.6	157	99.4
750	1	0.6	158	100.0

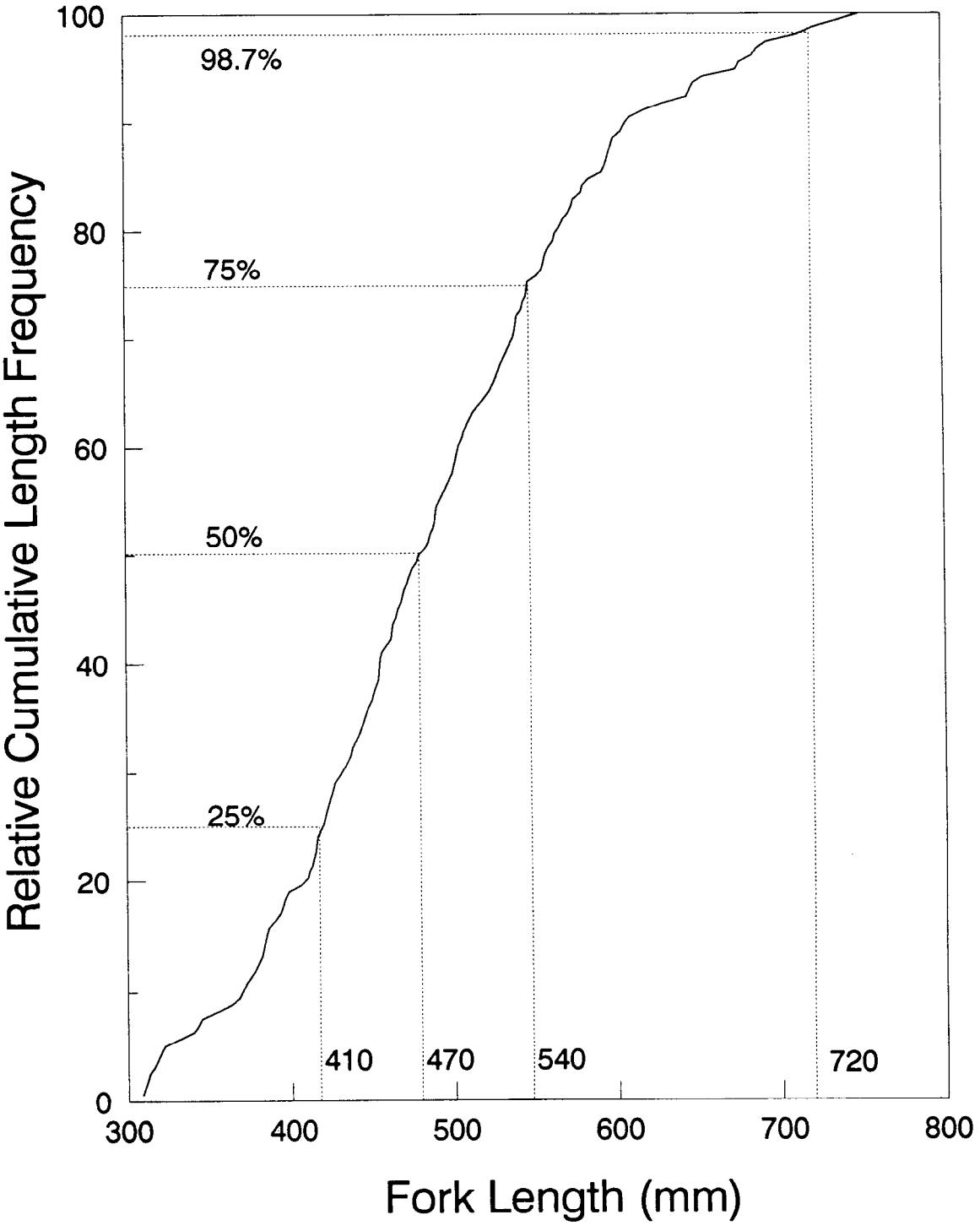

Figure 3. Cumulative length frequencies of northern pike capture in the Chena River, 1993.

Table 4. Age frequency of northern pike (>299 mm FL) in the sample taken from the Chena River, 1993.

Age	Sample Size	Proportion
2	4	.028
3	21	.148
4	44	.310
5	44	.310
6	17	.120
7	9	.063
8	1	.007
9	2	.014
Total	142	

Table 5. Estimated length-at-age for northern pike (>299 mm FL) in the sample taken from the Chena River, 1993.

Age	Length (mm)	SE	Sample Size
2	337	16	4
3	376	9	21
4	446	6	44
5	518	7	44
6	571	13	17
7	653	15	9
8	750	---	1
9	725	13	2
Total			142

Table 6. Summary of data on radio-tagged northern pike from the Chena River and Badger Slough, 1993 to 1994.

Fish Number	Frequency	Tag Number	Length	Sex	Tagging Date 4/26-5/7	Relocation by Date 5/27	6/17	10/12	2/1-2	4/25	5/3[8]
1	149.220	P78	523	F	B[1]	NM[3]	NM	NM	NM	NM	DNM[7]
2	149.349	P87	619	F	B	NF[4]	NM	NM	NM	NM	DNM
3	149.460	P93	536	M	B	NM	NF	NM	NF	Up6	NM
4	149.309	P84	470	M	B	Up4[5]	NF	NM	NM	DN2	NF
5	149.301	P83	456	M	B	NF	Up15	NM	NM	NM	DNM
6	149.439	P91	530	F	B	NM	NF	DN6	NM	Up5	NF
7	149.151	P76	451	F	B	Up1	NF	NF	Up4	NM	NF
8	149.260	P80	468	M	B	DN3	NF	Up18	NM	DN3	NF
9	149.288	P82	454	F	B	DN3	NM	NM	NF	NM	DNM
10	149.253	P95	478	M	C[2]	NF	NM	NM	NM	NM	DNM
11	149.282	P81	448	M	C	NM	NM	NM	NM	NM	DNM
12	149.450	P92	511	F	C	NF	NM	Up3	NM	NM	NF
13	149.210	P77	540	M	C	NF	NF	DN18	Up8	NM	NF
14	149.369	P89	530	M	C	NF	D[6]	---	---	---	---
15	149.340	P86	546	F	C	NF	NF	NF	DN9	NF	NF
16	149.357	P88	507	F	C	NF	NM	NM	NM	NM	DMN
17	149.321	P85	712	F	C	NF	DN2	NF	NF	NF	NF
18	149.242	P79	737	F	C	NF	DN2	Up10	DN2	NF	NF
19	149.171	P94	685	F	C	NF	NF	NF	Up2	NM	NF

1. Badger Slough implant.
2. Chena River implant.
3. NM = No movement.
4. NF = Not found.
5. Up or DN = up- or downstream; relative movement in km (>1 km).
6. D = Dead; tag recovered (8 a.m. angler).
7. DNM = Assumed dead - no movement.
8. Ground based search.

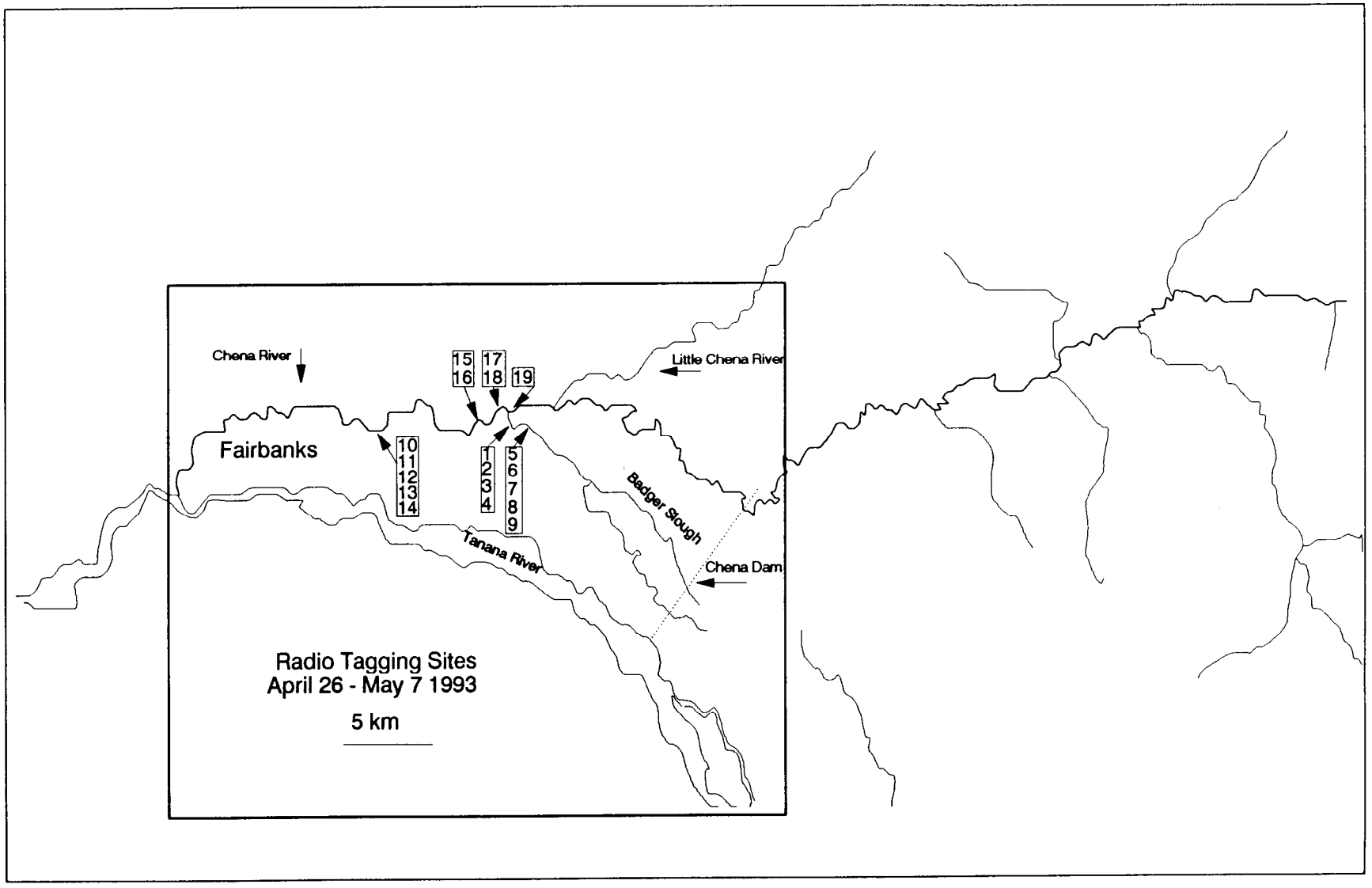

Figure 4. Location of radio tagging sites for northern pike in the Chena River, 26 April to 7 May 1993.

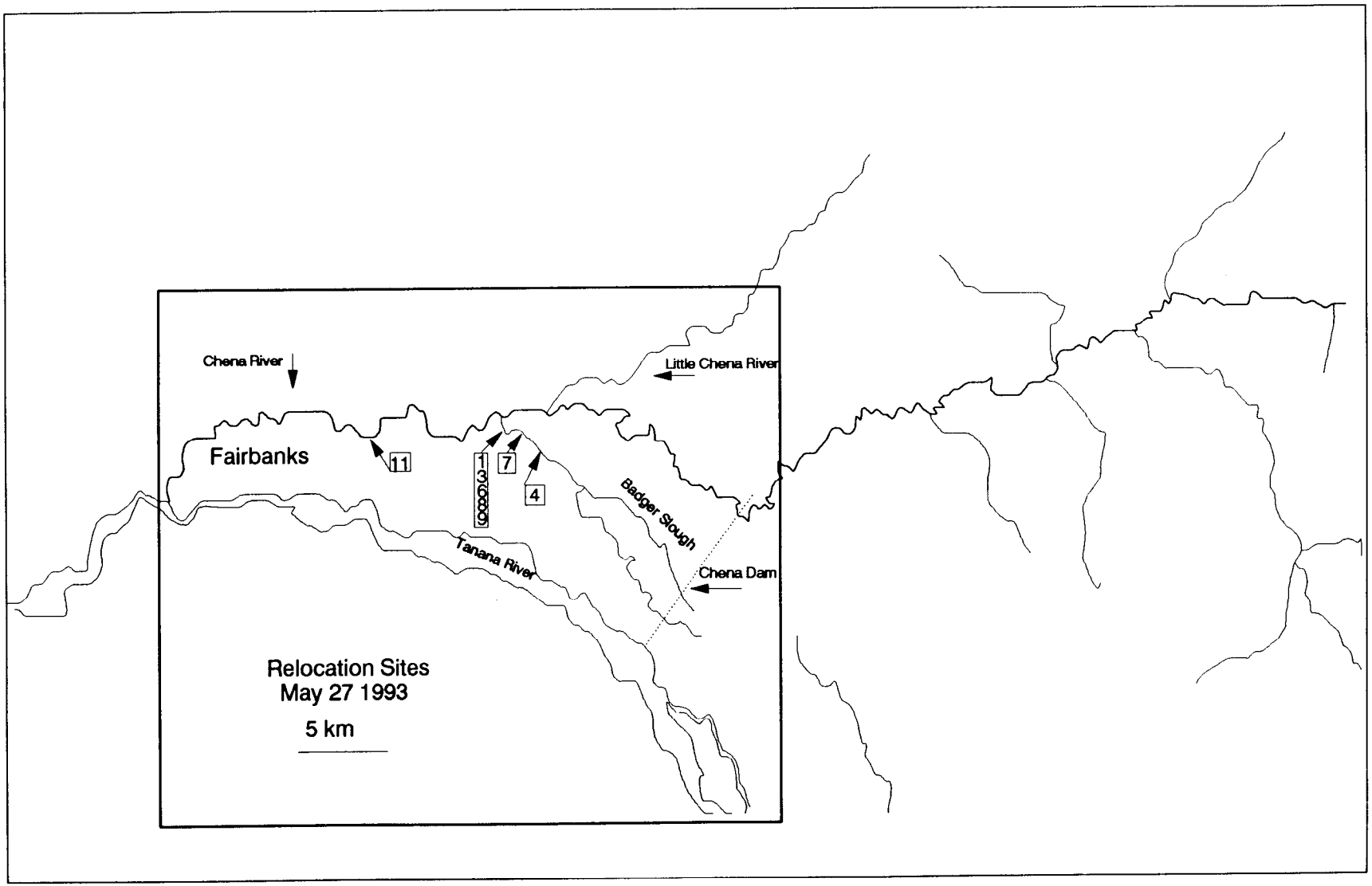

Figure 5. Relocation sites of northern pike in the Chena River 27 May 1993.

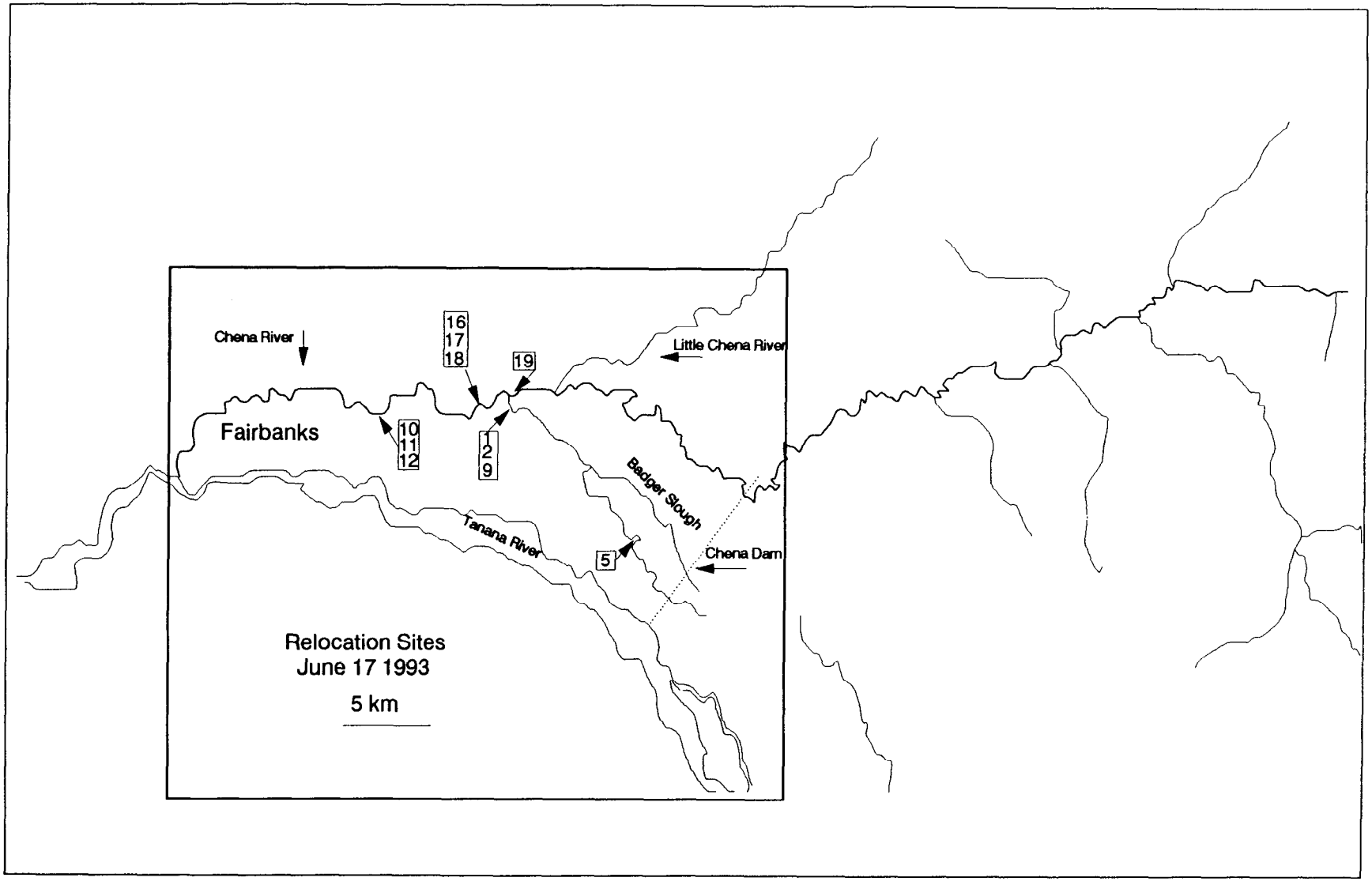

Figure 6. Relocation sites of northern pike in the Chena River 17 June 1993.

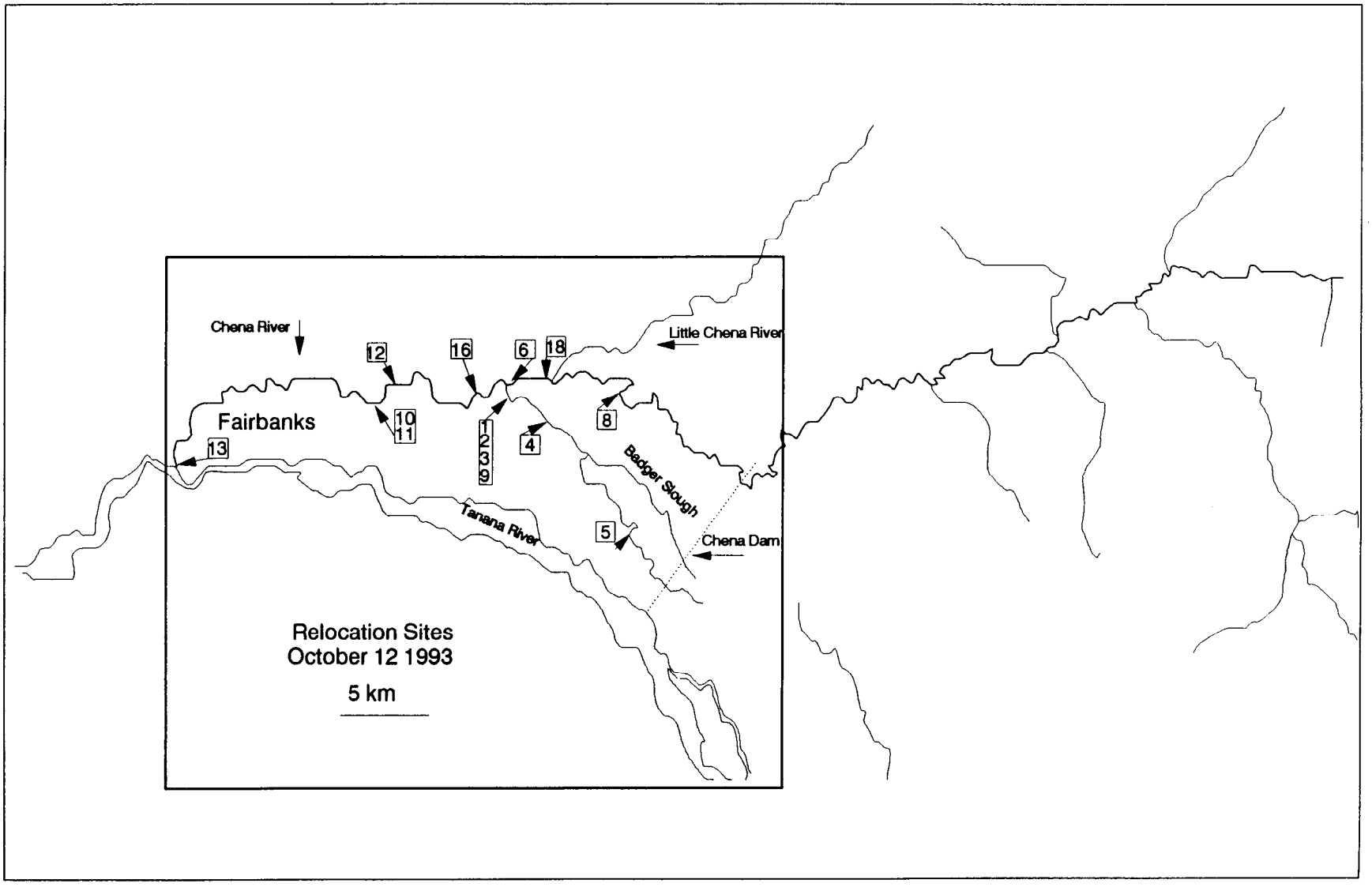

Figure 7. Relocation sites of northern pike in the Chena River 12 October 1993.

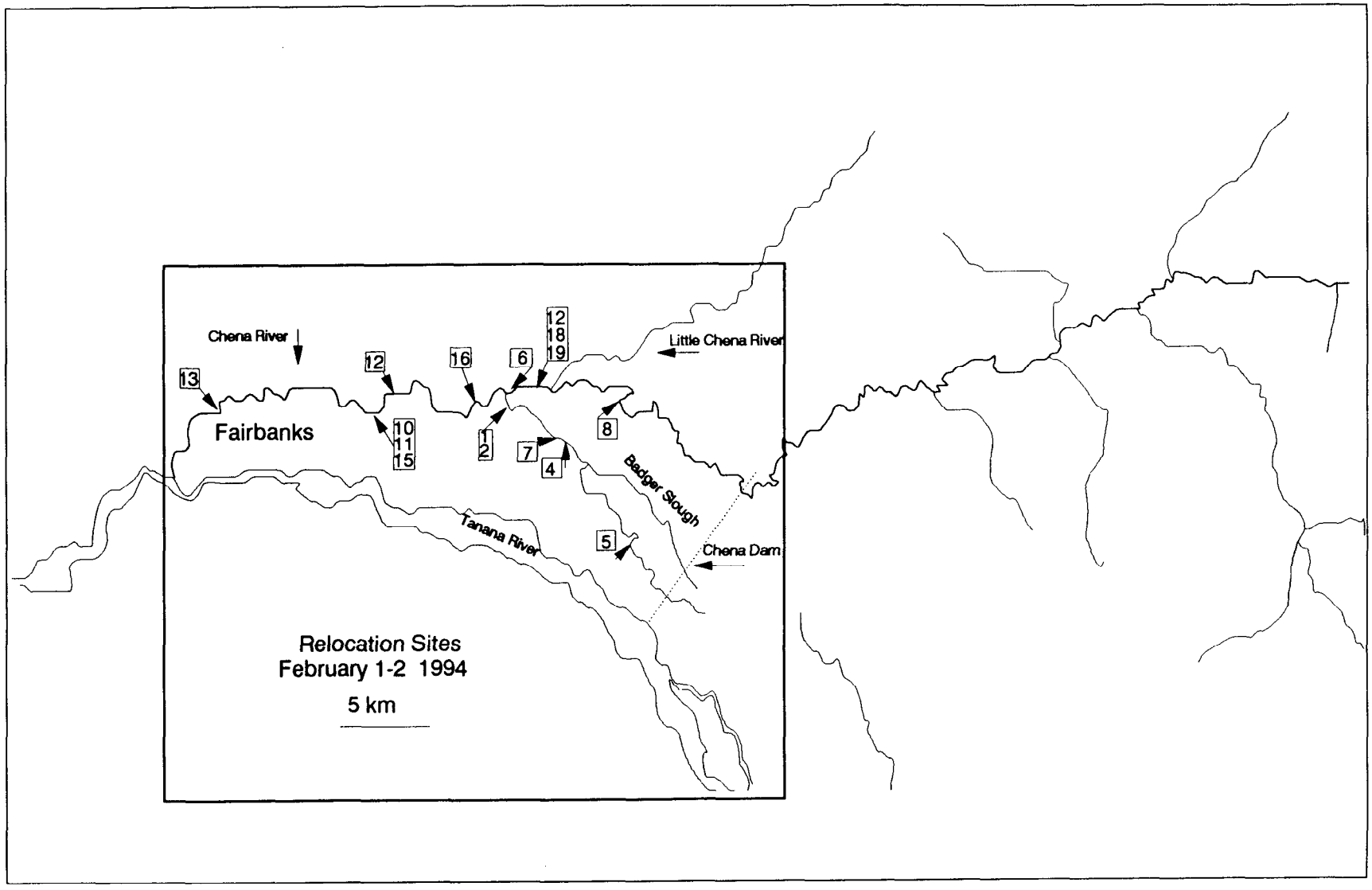

Figure 8. Relocation sites of northern pike in the Chena River 1 - 2 February 1994.

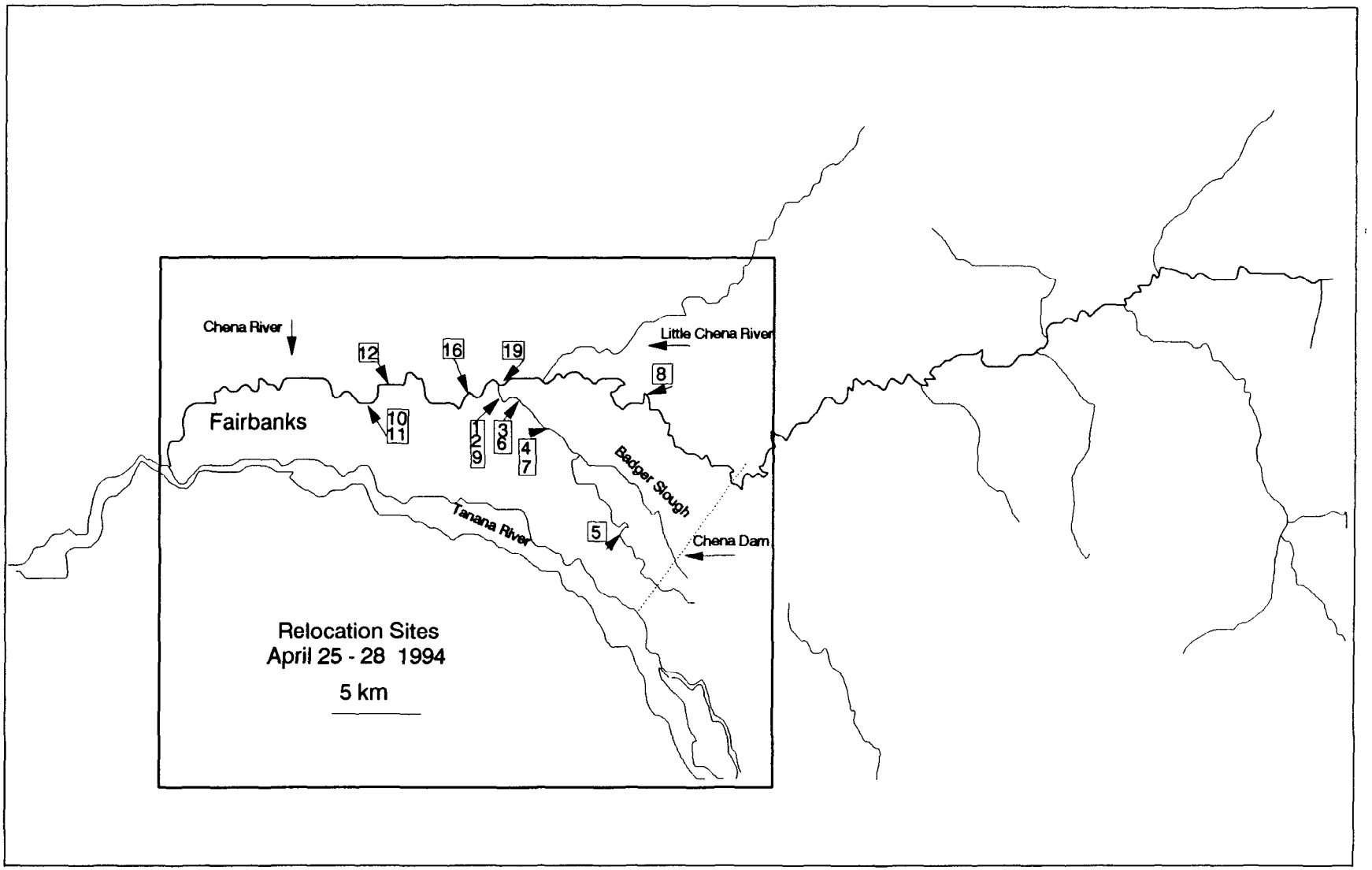

Figure 9. Relocation sites of northern pike in the Chena River 25 - 28 April 1994.

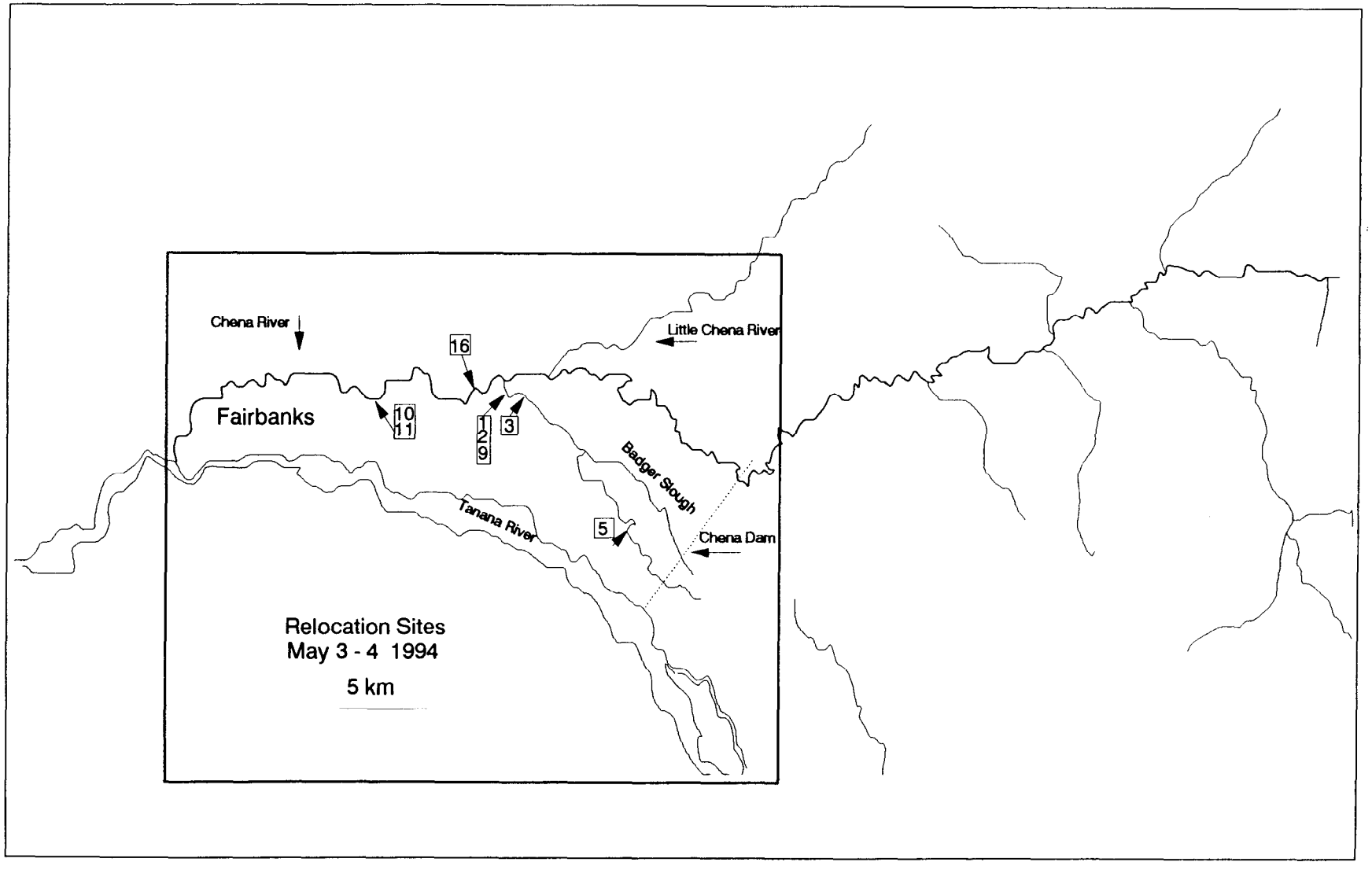

Figure 10. Relocation sites of northern pike in the Chena River 3 - 4 May 1994.

nine fish, three (numbers 10, 11, and 16) were assumed dead. Relocation data for these three northern pike indicated no movement occurred after implant, and these fish probably died early on in the study. All of the remaining six northern pike (numbers 12, 13, 15, 17, 18, and 19) showed some movement during the study. One (number 13) moved down the Chena River 18 km to its mouth by mid-October 1993, then back up 8 km by early February 1994, when it was last relocated. Another (number 15) was relocated in early February 1994, 9 km below its original tagging location, after which it was not found. None of the three remaining northern pike tagged in the Chena River (numbers 17-19) were relocated during the spawning period in early May 1994.

It is highly probable that northern pike sampled in late April and early May 1993 were captured in proximity to their spawning areas. This was indicated by the pre-spawning ripeness of all fish captured. These locations (Badger Slough, Chena Marina, and the upper and lower mouths of Columbia Creek and Steele Creek) contain areas of very low current velocity and associated aquatic vegetation. Such areas comprise a small portion of the river channel and are very likely critical habitat and should be protected for spawning purposes.

Later sampling conducted in portions of the lower and upper Chena River from 29 June, 1993 through 22 July, 1994 resulted in the capture of post-spawning northern pike located in slow water sections of the main Chena River channel. The area of the Chena River near the Chena Flood Control Project, primarily the boat launching area, and Potlatch Creek downstream of the dam, contain an abundance of northern pike that probably spawn nearby but were not sampled during that critical period in early May. There are reports of potential spawning habitat in the upper Chena River above the dam, associated with adjacent oxbows (old river channels) connected to the main river, but these were not investigated.

In summary, six of the 19 fish that were radio tagged probably died very shortly after being tagged. One tagged fish was harvested by an angler less than one month into the study. Of the remaining 12 radio tagged fish, relocations were only successful 49% of all attempts (37 of 75). Of the 37 successful relocations of the 12 fish that probably remained alive throughout the study, 17 showed no movement. Of the 20 relocations that showed movement, 13 relocations showed movement of 5 km or less, four showed movement of 6 to 10 km, and three showed movement of over 10 km. The largest single movement between relocations was 18 km. Movements were almost evenly split between upstream (11) and downstream (9).

The limited data available indicate that the radio tagged northern pike in the Chena River mostly displayed only local movements from the vicinity of the spawning areas near which they were initially tagged. While the data available from this study indicate only limited movements, the high rate of initial mortality and the inability to relocate fish reliably diminished the ability to draw conclusions about patterns of seasonal aggregation and

dispersal of northern pike in the Chena River. Weak signal strength emitted by the transmitters and interference from radio transmissions in Fairbanks likely contributed to failed relocations of radio tagged fish during this study.

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